Smart Solar-Powered Smart Agricultural Monitoring System Using Internet of Things Devices

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Chapter 9
Smart Solar-Powered Smart Agricultural Monitoring System Using Internet of Things Devices

Paras Patel, Anand Kishor, and Gitanjali Mehta

Abstract India is the fastest-growing big financial system in the world, with a massive population, useful demographics, and excessive catch-up potential. In India, agriculture is a primary activity, around two-third of India's population remains dependent upon agriculture. In developing nations, farmers aren't using smart agricultural technique but if they begin the use of smart agricultural technique with the assist of this technique, they can produce good yield crops, wide range of development on the agriculture, and can make superior amount of profit. To reduce long-time expenditure in agriculture, use of renewable energy is important for that smart solar is the primary energy which may be used.

Keywords Smart solar system · GSM module · Internet of things

1 Introduction

India is the speediest growing enormous economy on the planet, with a huge populace, helpful demographics, and excessive catch-up potential. In essential area of economy, exercises are attempted through on double utilizing common assets. Farming, fishing, dairy, and other normal items are alluded to as so in light of the fact that they shape the base of all particular item. Since limit of the characteristic time we get is from farming, dairy, fishing, it is likewise called agriculture and unified area [1–3]. Agriculture plays a fundamental capacity inside the Indian monetary framework. More than 70% of the rustic families rely on farming. Agriculture is a significant

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Fig. 1 Smart solar system

area of Indian monetary framework since it makes commitments around 17% and large GDP and gives work to more than 60% of the populace [4–6]. Agriculture is the technology & artwork of cultivation of plants & domestic animal. Farming was the evolution for development of mankind. For example,—Punjab, Haryana, Uttar Pradesh. Figure 1 shows a smart solar system with the following specifications:

- Area—200 square feet
- Cost—2–3 Lakh
- Output—2.5 kw
- Average annual energy output—5000kwh
- Size of solar cell—156 mm by 156 mm
- Diameter—16 feet
- No. of slides—12
- Weight—400–450 kg.

2 Proposed System Design and Working Principle

Present-day farming is another and rising idea utilized in developing the yield of a harvest with the aid of using advanced technology to help in conventional cultivating rehearses. Ideas, for example, exactness in Agriculture (PA), Internet of Things (IoT), Wireless Sensor Networks (WSN), and many other techniques are utilized with conventional framing to help in the profit of harvests, growing efficiency, and controlling of expenses. The purpose of the execution is to exhibit the smart and brilliant

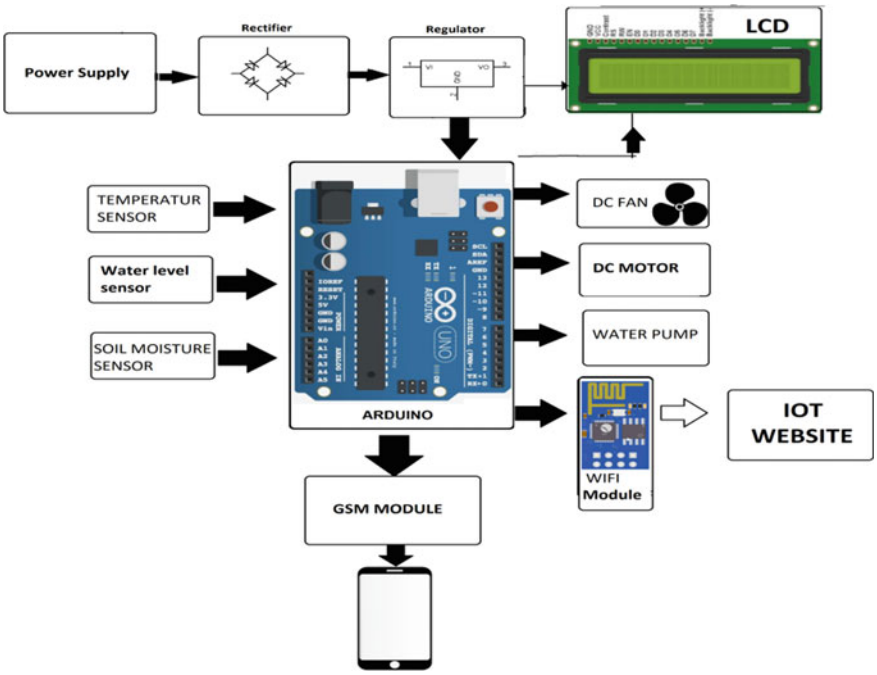

Fig. 2 System design

abilities of the microprocessor to permit the choices to be taken on irrigation of the vegetation, checking the temperature of fields, soil moisture, and many more based on the non-stop tracking of the ecological conditions in the field [7, 8].

Figure 2 shows the designed system. There are many different types of sensors which are used in our system. These sensors are constantly observing the parameters & forward it to the Arduino board for additional handling which goes about as an IoT gateway. "This passage has been given the wireless service by putting in a GSM module which will be updating the records to the cloud". With the help of GSM module, we can also able to operate our device over 2G and 4G networks.

The frameworks have been diverse in that the sensor hubs planned, utilized explicit detecting units for tracking surroundings. In sensor hubs comprised of soil wetness, temperature, air humidity, and laser sensors. In sensor hubs, the best effective is to acquire a soil wetness sensor. In most of the gadget planned, hubs didn't contain any energy gathering gadgets, and as such could best effective capacity for a specific time period earlier than the hub's energy flexibility could need to be supplanted. In this work, we expand on top of these recently published works, and furthermore exploit the segments that take lead of the element present in the blueprint of a remote IoT organization [9, 10].

Sensors networks have been geared up with photovoltaic panels for power harvest to be able to rise the overall run-time of the network. When sensor information was

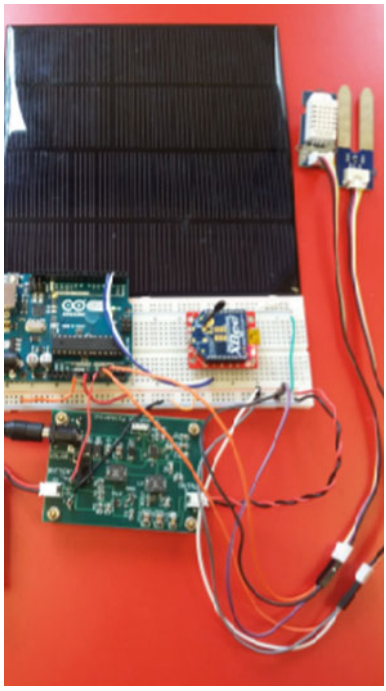

Fig. 3 Assembled system with components

estimated and conveyed to the objective, time stamps were set on the bundles and stock, which would then be able to be explored later to decide any potential activities that are expected to additional consideration of the yields [11, 12]. Figure 3 shows the assembled system with different components.

3 Sensor Description

To gauge the particular ecological conditions needed in an agricultural positioning framework, two kinds of sensors have been used:

(1) **Soil wetness sensors**

The Grove Soil Wetness Sensor is fit for estimating the dampness content material inside the soil. This sensor was chosen as it can properly check the volumetrically water contendent material inside the dirt in a roundabout way by utilizing the electrical obstruction among the two pushes. This is helpful in rural frameworks, for the explanation that through realizing the dampness levels inside the dirt, fields could best need to be flooded when needed and will restrict the expansion of microorganisms [2]. Figure 4 shows the assembled soil moisture sensors with equipment.

(2) **Humidity and Temperature sensors**

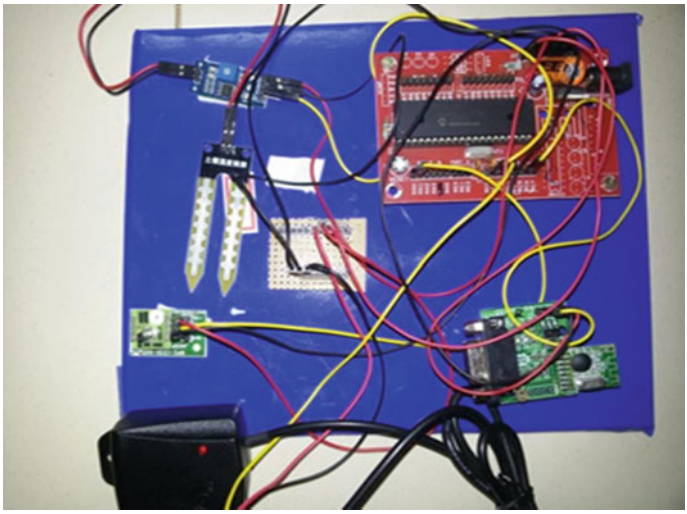

Fig. 4 Assembled soil moisture sensors with other equipment

Figure 5 shows the assembled humidity and temperature sensor. Temperature and mositure sensor can estimate the natural data with skimming point precision, up to 0.4° for temperature and 2% for comparable dampness. This sensor was chosen as most extreme harvests will create the best yield while the temperature and dampness are inside an ideal range. These estimations end up being fundamental in nurseries as

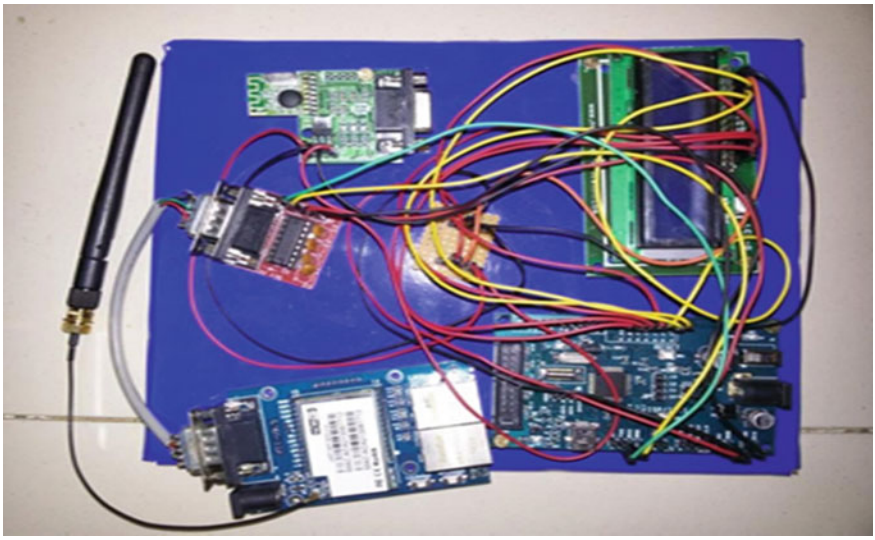

Fig. 5 Assembled humidity and temperature sensor

Fig. 6 Connected router with model

open-air circumstances can altogether influence those inside the nursery. The ability to control the circumstances can altogether help with inside the improvement of the plants itself as most required definite temperature and mugginess stages at some point of the different levels of growth [3–14]. Figure 6 shows the connected router with model.

(3) **Obstacle sensor**

This sensor can work at the standard of sound waves and their appearance property. It has two sections such as supersonic transmitter and supersonic recipient. Transmitter communicates the 40 kHz sound wave and, on its gathering, it imparts the electric sign to the miniature regulators. The speed of sound in air is now known.

Subsequently from time needed to get again the sent sound wave, the hole of hindrance is determined. Here, it is utilized for impediment location if there should be an occurrence of cell robot and as a development finder in product habitation for halting burglaries. The supersonic sensor permits the robot to find and avoid hindrances and furthermore to gauge the hole from the deterrent. The scope of activity of supersonic sensor is 10–30 cm.

4 Software Used

(1) Arduino IDE

When operating with the InduinoR3 Board, select the board as Arduino UNO from the Tools Boards sequence and choose the Appropriate Com Port.

(2) AVR Studio Version 4

It is utilized to compose, manufacture, compile, and troubleshoot the implanted C program codes that have been consumed in the miniature regulator to have the option to perform wanted tasks. This software program promptly gives.hex file that can be effortlessly consumed into the miniature regulator.

Proteus 8 Simulator

Proteus 8 is single of the extraordinary reenactment programming program for different circuit designs of miniature regulator. It has virtually all miniature regulators and computerized segments that are promptly accessible in it and along these lines it far generally utilized test system. It might be utilized to check program and embedded drawing for gadgets before genuine equipment examination. The simulation of programming of micro-controller likewise can be completed in Proteus. Simulation avoids the opportunity of harming apparatus because of inaccurate plan. Figure 7 shows the program codes.

The advantages and disadvantages of the proposed system are as

Advantages

- Actual-Time Data & Productivity Insight
- Low Operation Expenses
- Increased Quality of Productivity
- Accurate Farming and Field Rating
- Third eye Monitoring
- Water Conservation
- Increasing renewable energy.

Disadvantages

- The Cost Involved in Smart Agriculture
- There could be wrong Analysis of Weather Conditions
- Reliability
- Increased channel maintenance.

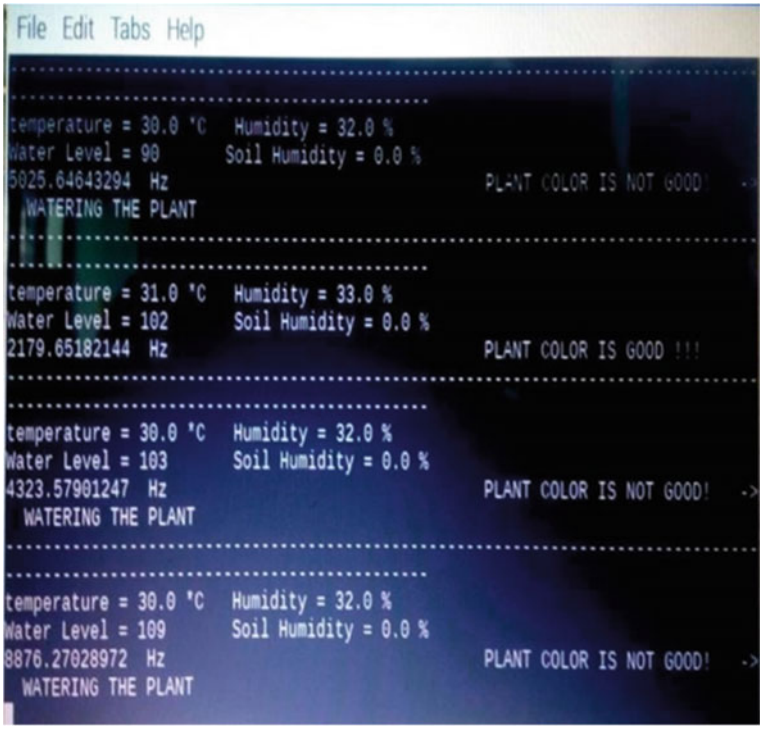

Fig. 7 Program codes

5 Conclusions

Smart Agricultural Field observing framework can assume a significant function in Agricultural countries. Through this framework, soil condition can be monitored. This framework can assist with continuing cultivation and accurately. This framework forestalls the misuse of water. Some more sensors with more information investigation should be possible as future work of this chapter. IoT sensors have high efficiency and accuracy, so it is easy to obtain the direct data of ground wateriness and warmth in agriculture field. The water stages indicator is used, so prevents the waste of water and saves water; it helps the farmers to expand their production. By forcing this framework, farming, plant lands, parks, gardens, golf courses can be irrigated. Thus, this device is more affordable and proficient when contrasted with various types of mechanization gadget. In huge scope applications, high sensitivity sensors can be applied for huge regions of agricultural grounds.

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